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REVIEW OF I. YA. RYSHKOVSKIY'S BOOK "TRACTION SUBSTATIONS"

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This book was written with the aid of contemporary scientific and technical material and represents long Soviet experience (including the author's) in the planning, equipping, and operation of traction substations serving electrified railroads. The title of the book does not exactly describe its contents since traction substations serving streetcars and trolley buses are not considered here. The book consists of an introduction, ten chapters, and a number of appentices.

The introduction consists of a short historical review of the development of electric traction in the USSR, a description of the supply system for electrified railroads, and an evaluation of the efficiency of various elements in this system. Diagrams represent graphically the technological processes involved in producing, transmitting, converting, and using electric power for electric traction. Although the author correctly recognizes the priority of Russian scientists in the field of power transmission along wires, he neglects to mention that Engineer F. A. Pirotskiy (1874) was the pioneer of long-distance power transmission.

The first chapter deals with basic equipment in traction substations, and includes mercury rectifiers, traction transformers, and motor-generators. To avoid duplication, the author limits himself to those questions directly connected with the selection of a type of converter suitable for a specific traction load, e.g., efficiency, overload capacity, dimensions and weight, initial cost, regeneration, voltage regulation, power factor, and finally operating conditions. This chapter also contains detailed equations for power losses in converter units, the use of which enables one to calculate annual losses and the annual efficiency of a substation for different types of converters and to determine their best operating conditions. With regard to the amount of power returned to a three-phase primary circuit by trains running downhill on railroads

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using motor-generator substations, the author reaches an interesting conclusion. It appears that the difference in annual losses (14%) between mercury rectifiers and motor-generators considerably exceeds the amount of power (2-4%) that can be returned to the primary, and it therefore allows that the use of motor-generators is uneconomical.

With regard to the overload capacity of converter units, the author concludes from the general theory of heating in electric machines that the utilization factor of traction substation equipment could be raised if units were selected after being checked for heating at the overload capacity.

The fault of this chapter is that it fails to provide power loss equations for Type RMNV-500x6 and Type RMNV-500x12 rectifiers and data on the cost of substations equipped with these rectifiers.

Chapter II deals with high voltage dc distribution systems for traction substations serving subways, local, and main-line railroads. It also explains the theory and application of various types of high-speed circuit breakers used for protecting the contact system and converter units from the effects of overloading and breakdowns. An analysis is given of the advantages and disadvantages of various bus-bar systems and the design of dc distribution panels, together with a description of the recently designed "side-structure" type which effects a considerable economy in building space and in the cost of the substation. Details are given of the structure, characteristics, and technical data for high-speed breakers including information on a new type designed by A. I. Golubev. This is a high-speed anode breaker used for protecting mercury rectifiers from arc-backs. The system used for protection against grounding, designed by TsNII (Central Scientific Research Institute of the Ministry of Transportation of USSR, and for the protection of dc subway cables are also described. Both systems have been checked personally by the author and are fully recommended for general use. Methods of protecting dc feeders are shown on pp 53-64.

It is considered that the theory of the inductive shunt in a high-speed breaker is described here in too much detail, while the widely used voltmeter interlocking of high-speed breakers is only touched upon and A. V. Ivanov's protection method for the contact system is not mentioned at all.

The third chapter deals with traction substations using mercury rectifiers. The value of this chapter lies in the detailed data, sketches, and diagrams showing supply and regulation systems for the new Type RMNV-500x6 and Type RMNV-500x12 rectifiers.

The fourth chapter deals with motor-generator substations. The author points out that long operating experience has shown that Type-KhEMZ (Khar'kov Electromechanical Plant) motor-generators are more reliable and efficient than similar machines made by foreign firms.

The fifth chapter describes the building of traction substations and contains a great deal of information of various types of subway, local, and main-line substation systems. It also discusses grounding systems. The specific volume (building space required per kilowatt of installed capacity) is an important factor in building economy. A comparison is made (p 159) between different types of indoor 35-kv substations on urban lines which were equipped at various stages of the electrification program. It was found that more efficient grouping of equipment in later types had reduced the specific volume of the buildings and improved the service. Further data on this subject is given on pp 160 and 164. This information is most useful for students, and the examples worked out for protective grounding in traction substations and for the selection of storage batteries are also of value. This chapter does, however, lack information on the installation of equipment in traction substations and internal power consumption by them.

Chapters VI and VII deal with ac substations and mobile substations. These chapters should have been supplemented by practical experience gained from our railroads.

Chapter VIII deals with automatic substations and is the most valuable chapter of all since there are virtually no reference books on this subject. After a short review of the development of automatic substations, the author discusses their technical and economical advantages and recommends that a decentralized electric supply system be used in conjunction with them. He also gives details on the basic specifications for telemetering and automatic control devices, equipment, and circuits. This chapter should also have contained information on how to design a decentralized electric supply system.

[The ninth chapter is not reviewed.]

The tenth chapter deals with the operation of traction substations and contains a considerable amount of interesting material on the utilization factor for equipment, and on arc-backs in mercury rectifiers. Although the author praises the work of Soviet operating personnel, he points out that a lot can still be done to raise the utilization factor, save electric power, reduce operational expenses, and increase efficiency.

The book gives valuable information on improvements developed by leading engineers and Stakhanovites working for the USSR electrified railroads, among whom are Comrades Logu, Mel'nikov, Dement'yev, Tavadze and Buslayev. The book is well illustrated (about 300 figures), and the sample calculations and appendices should prove useful for planners.

However, the book also has a number of faults. It fails to deal adequately with problems relating to short-circuit currents, protective relays, and high-voltage equipment, although technical students require knowledge of these subjects. It does not sufficiently emphasize economic problems such as the cost of conversion per kilowatt-hour internal power consumption, etc. The author quotes sources on various pages, but the lack of a separate bibliography is a great handicap. Finally, the book contains a number of misprints, and the titles of some of the sketches are badly worded.

The above-mentioned faults should be corrected in the next edition, for the book is of great value not only to students in technical transportation schools but also for engineers, technicians and Stakhanovites whose work is connected with electrical supply to our railroads.

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